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Chen

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(54) **OIL REPLACEMENT APPARATUS**

(76) Inventor: **Jui-Pin Chen**, Changhua (TW)

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B60T 17/22 (2006.01)

(52) **U.S. Cl.**
CPC ***B60T 17/222*** (2013.01)

(58) **Field of Classification Search**
CPC B60T 12/22
USPC 141/59; 188/352
See application file for complete search history.

(56) **References Cited**

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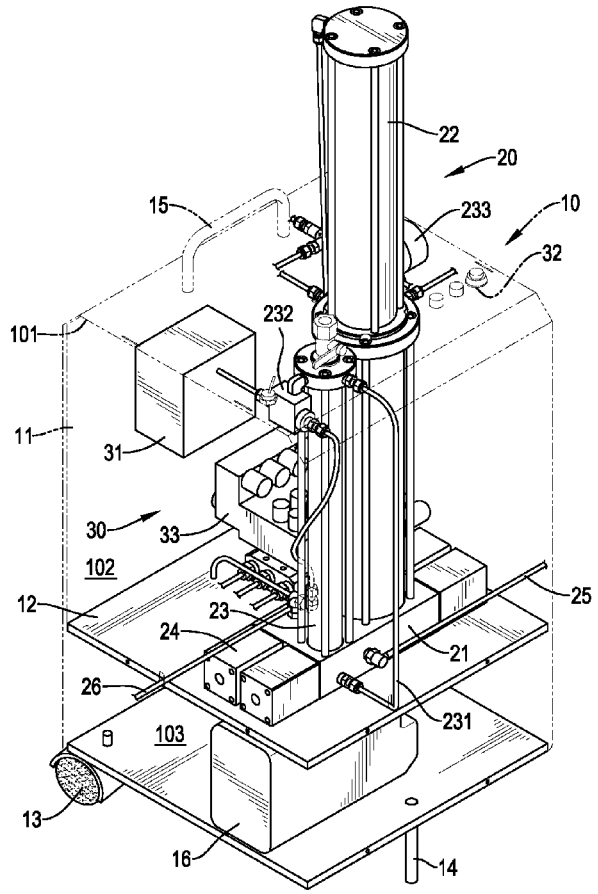
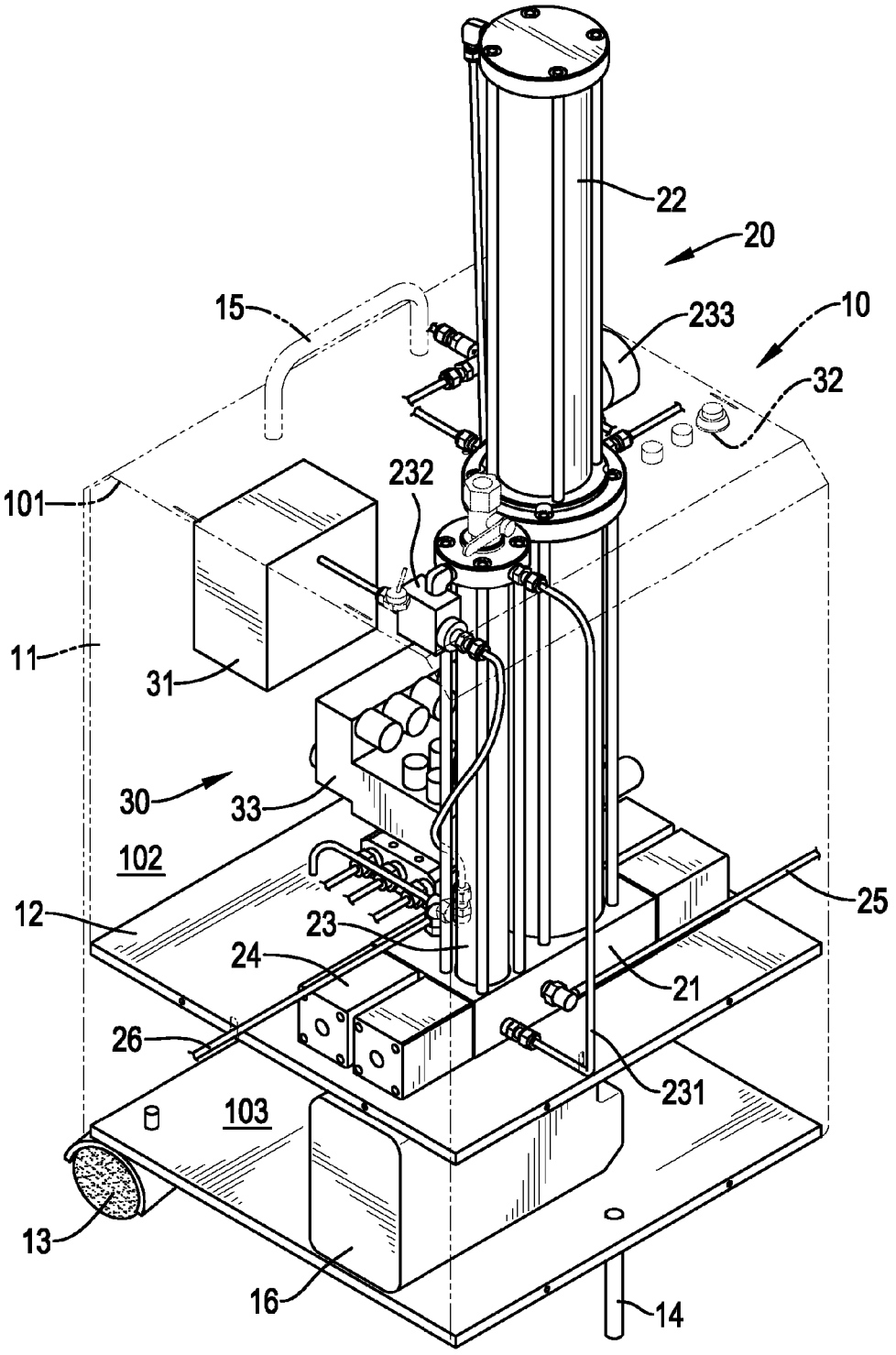
(57) **ABSTRACT**

An oil replacement apparatus has a housing, an oil replenishing assembly and a controlling assembly. The oil replenishing assembly has a base, a vacuum pump, an oil tank and multiple control cylinders. The base has a canal set formed inside the base. The vacuum pump and the oil tank are mounted on the base and communicate with the canal set. The control cylinders are mounted on the base to close the canal set and can selectively open or close holes of the canal set. The controlling assembly is connected with the oil replenishing assembly. Accordingly, the oil replacement apparatus can automatically drain or inject oil in a hydraulic brake assembly.

12 Claims, 10 Drawing Sheets

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233
10
32
232
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103
13
16
14

FIG.1

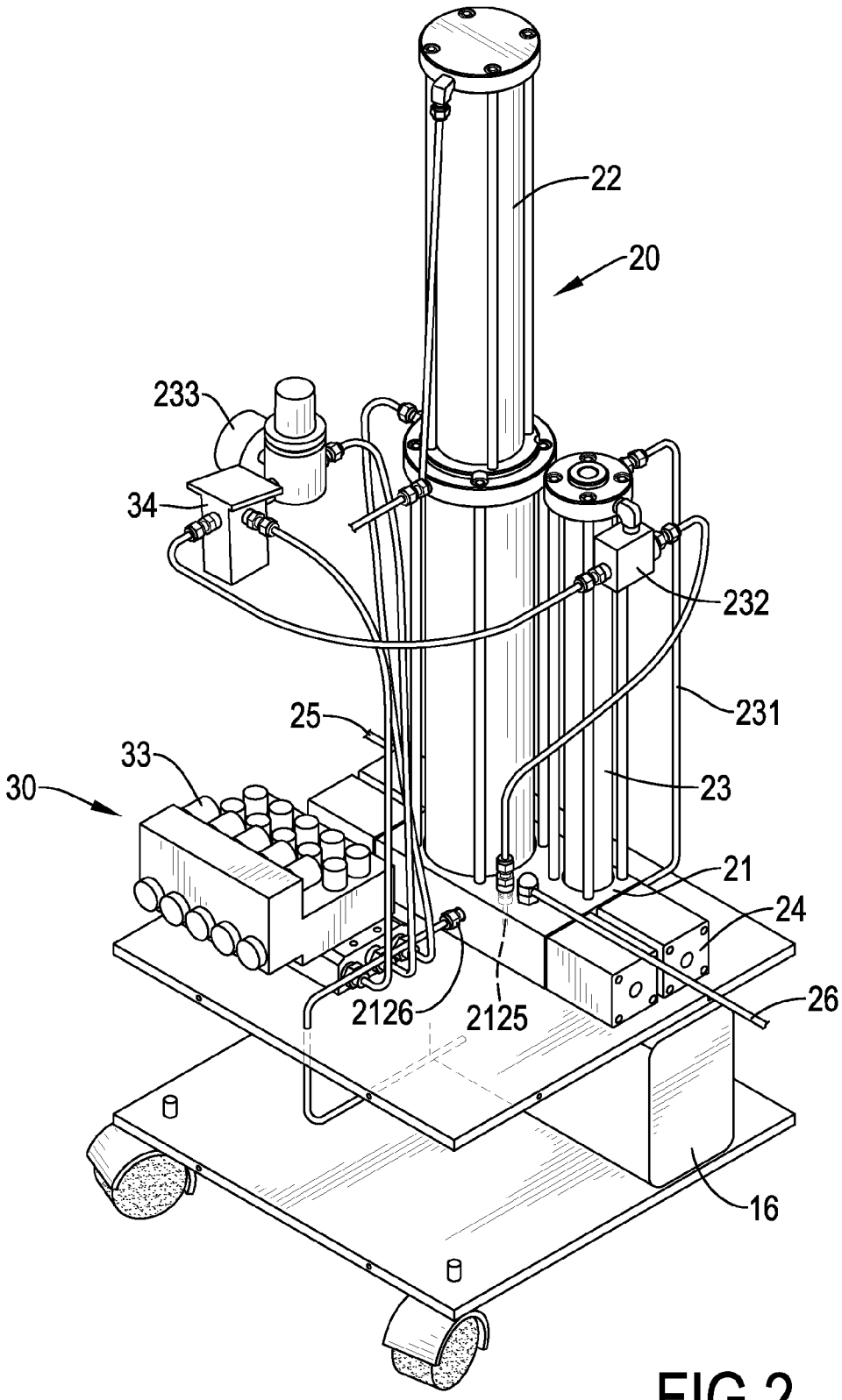


FIG.2

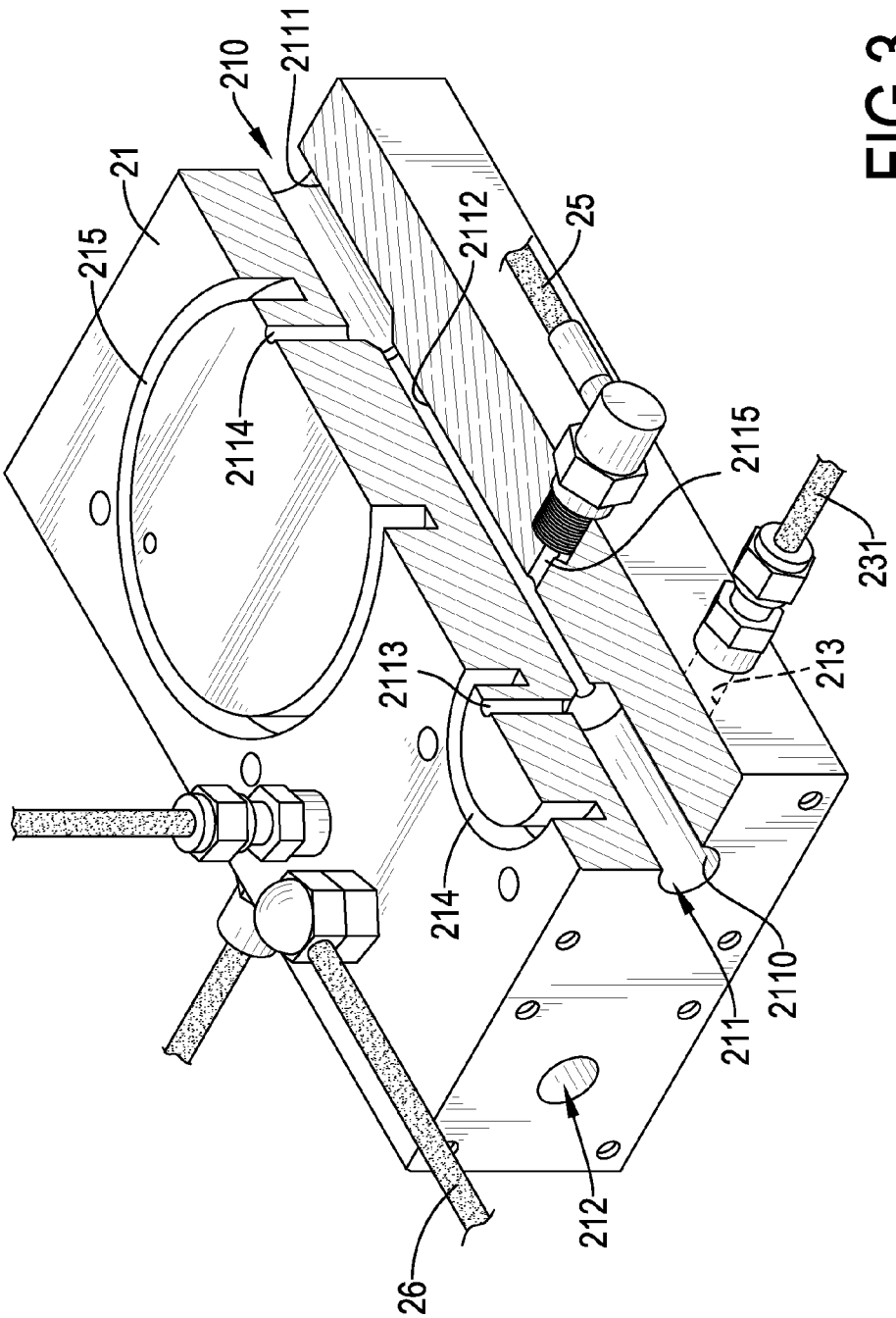
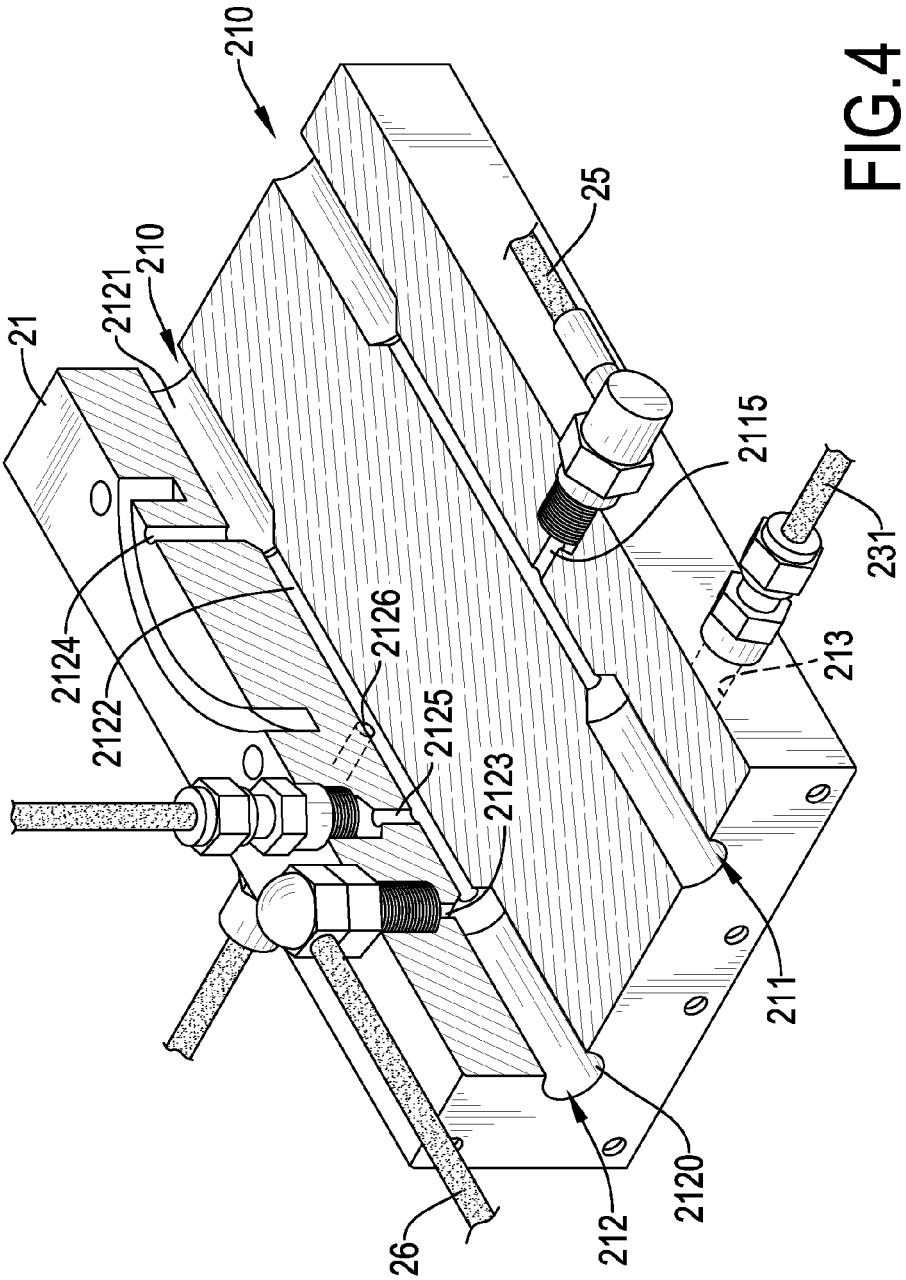

210
2111
21
215
2112
25
2114
2115
231
213
2113
214
2110
211
212
26

FIG.3


210
25
2121
210
21
2115
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212
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FIG.4

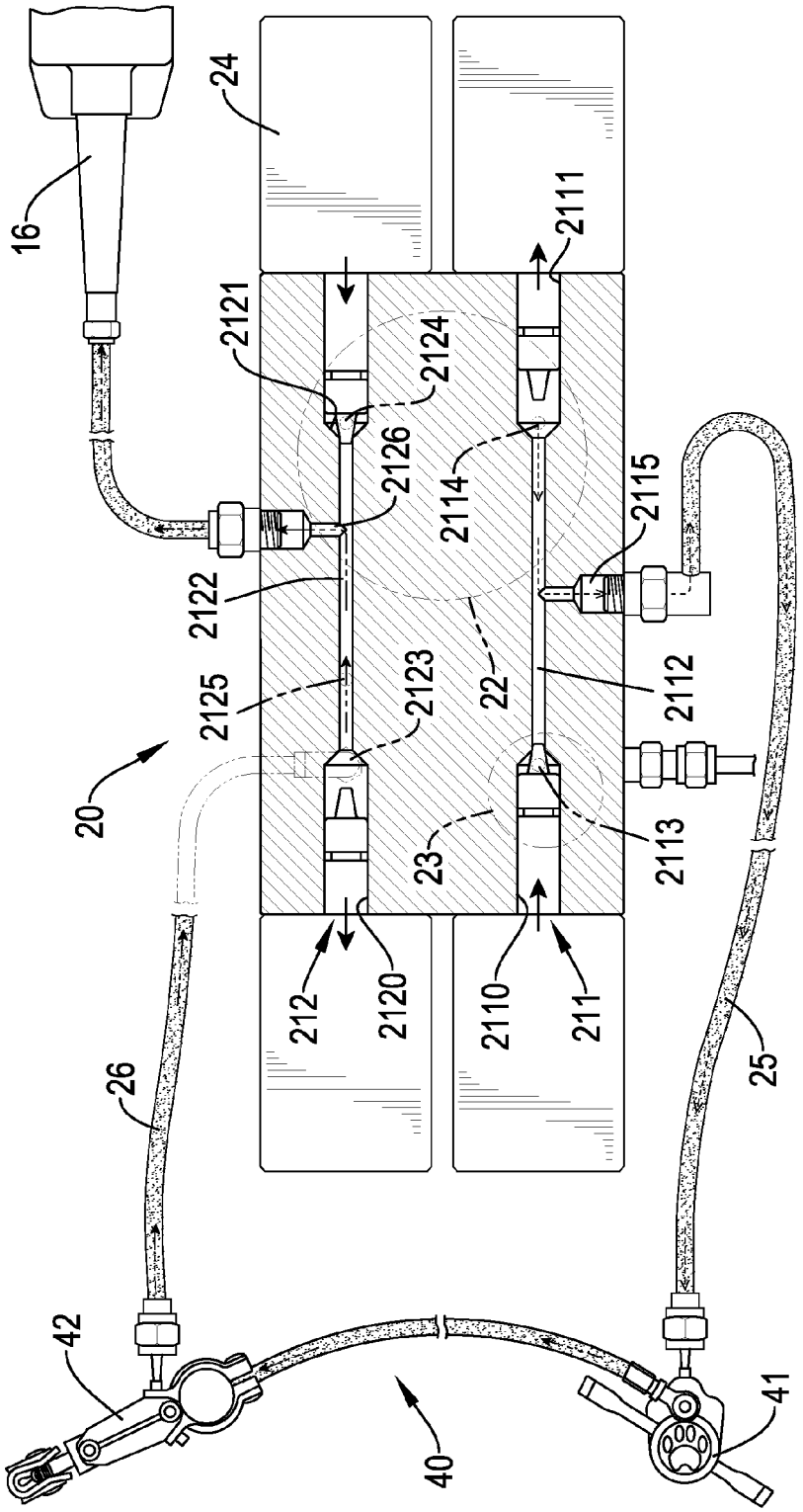
16
24
2111
2121
2124
2126
2114
2115
2122
2125
2123
22
2112
20
23
2113
212
2120
2110
211
26
25
42
41
40

FIG.5

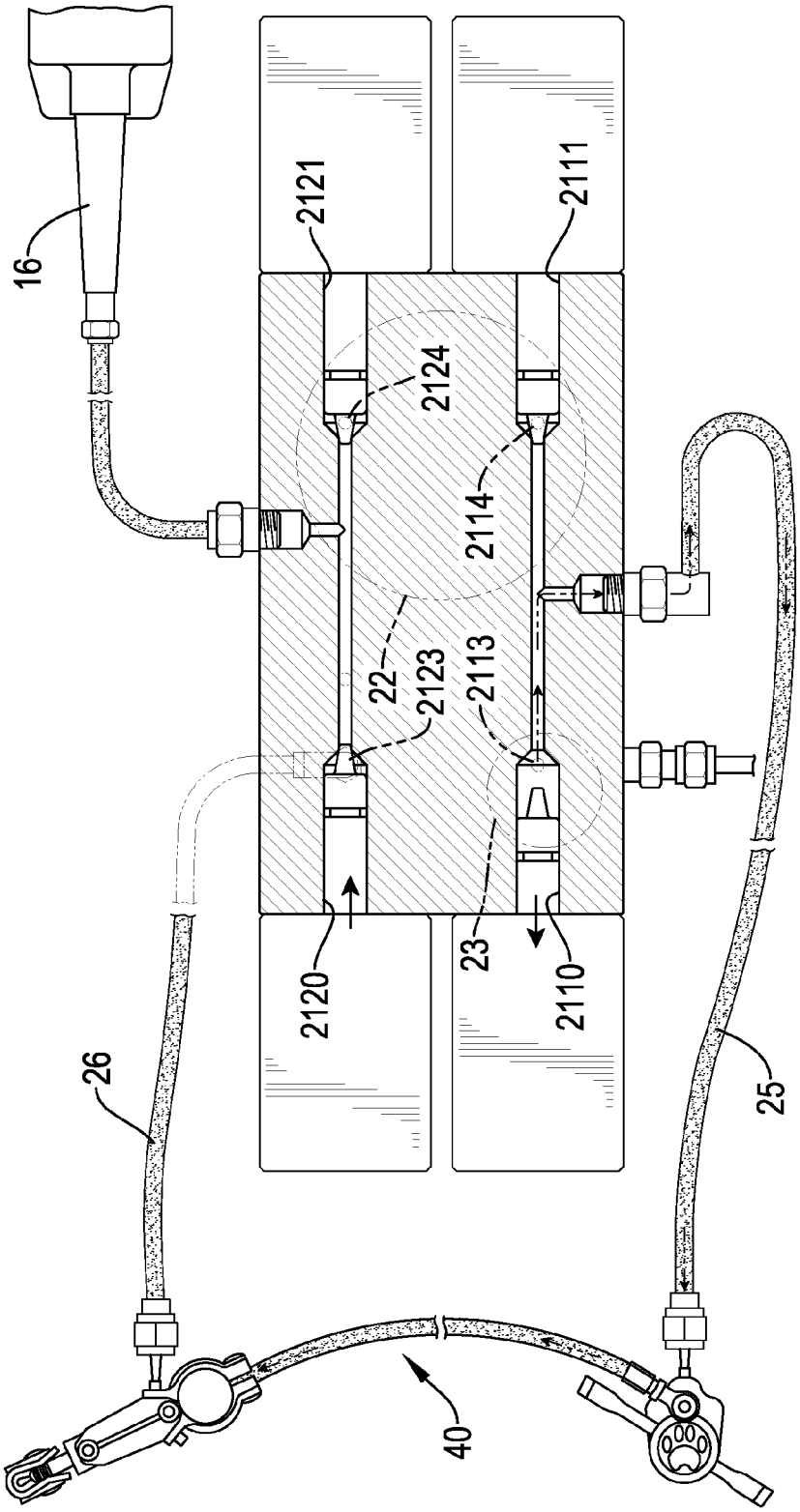

FIG.6

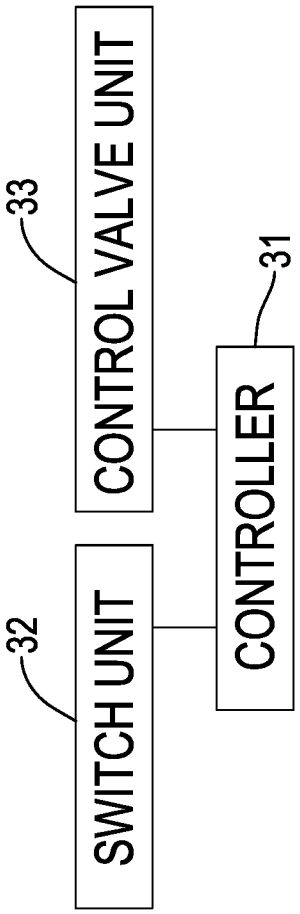

FIG.7

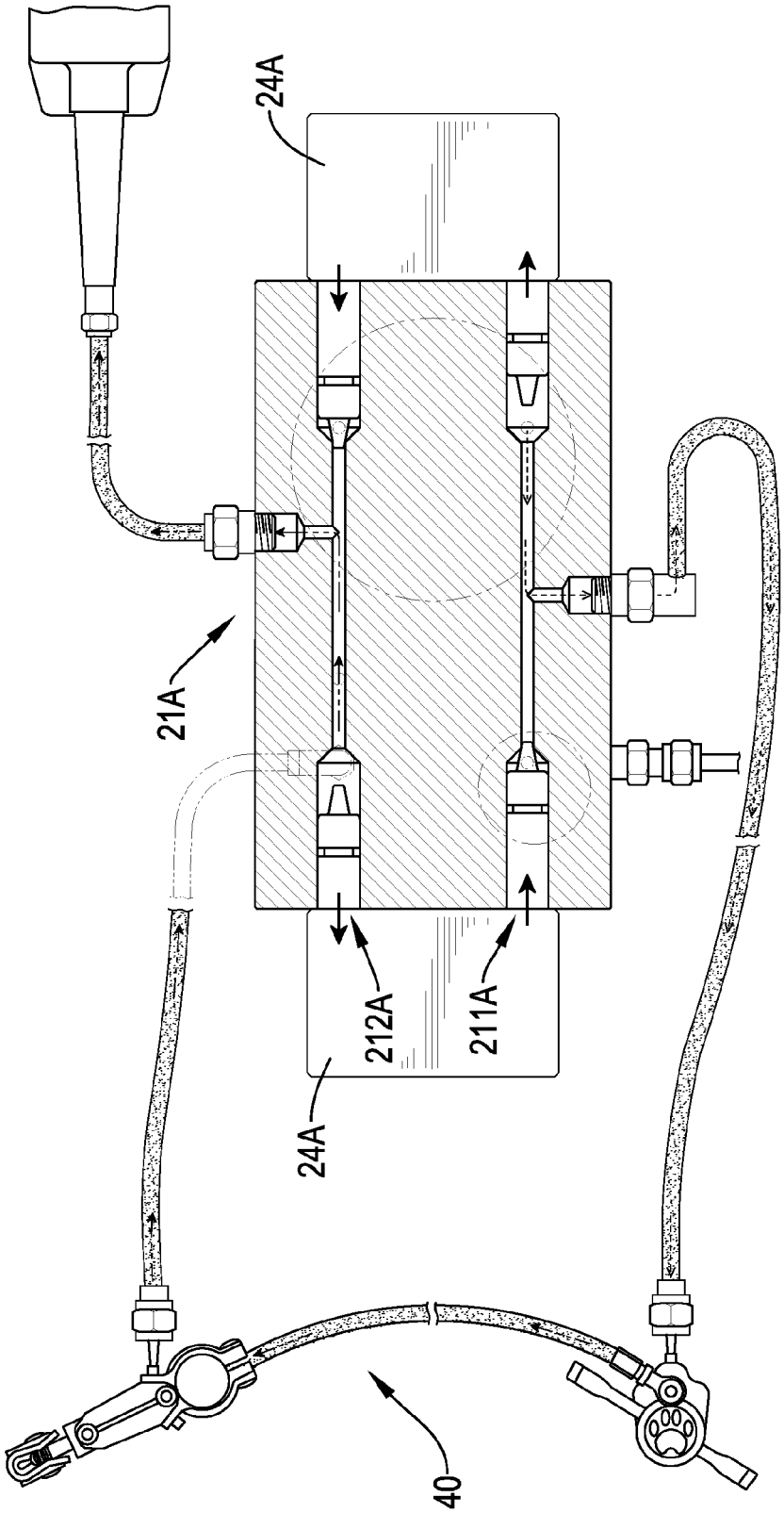

FIG.8

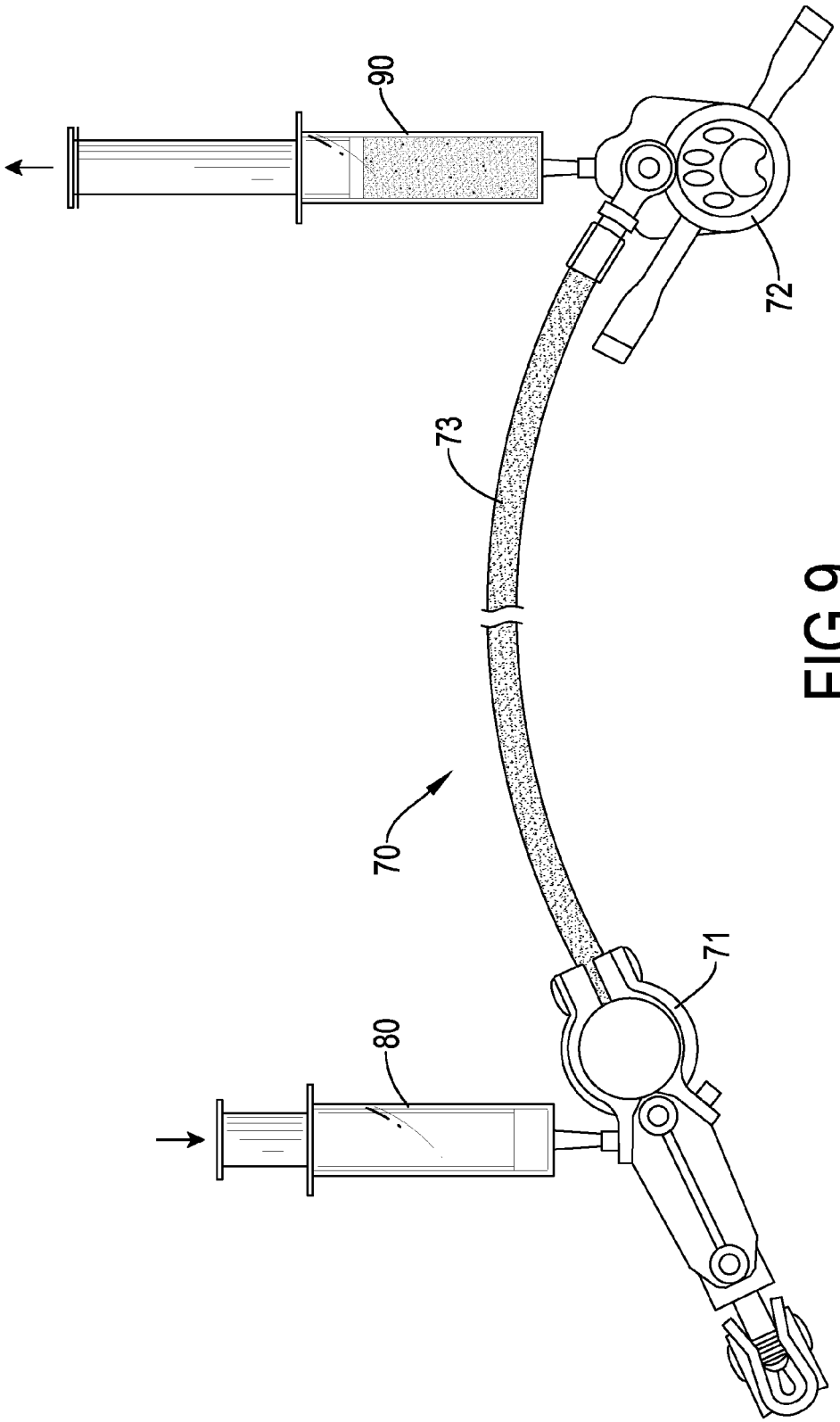

FIG.9
PRIOR ART

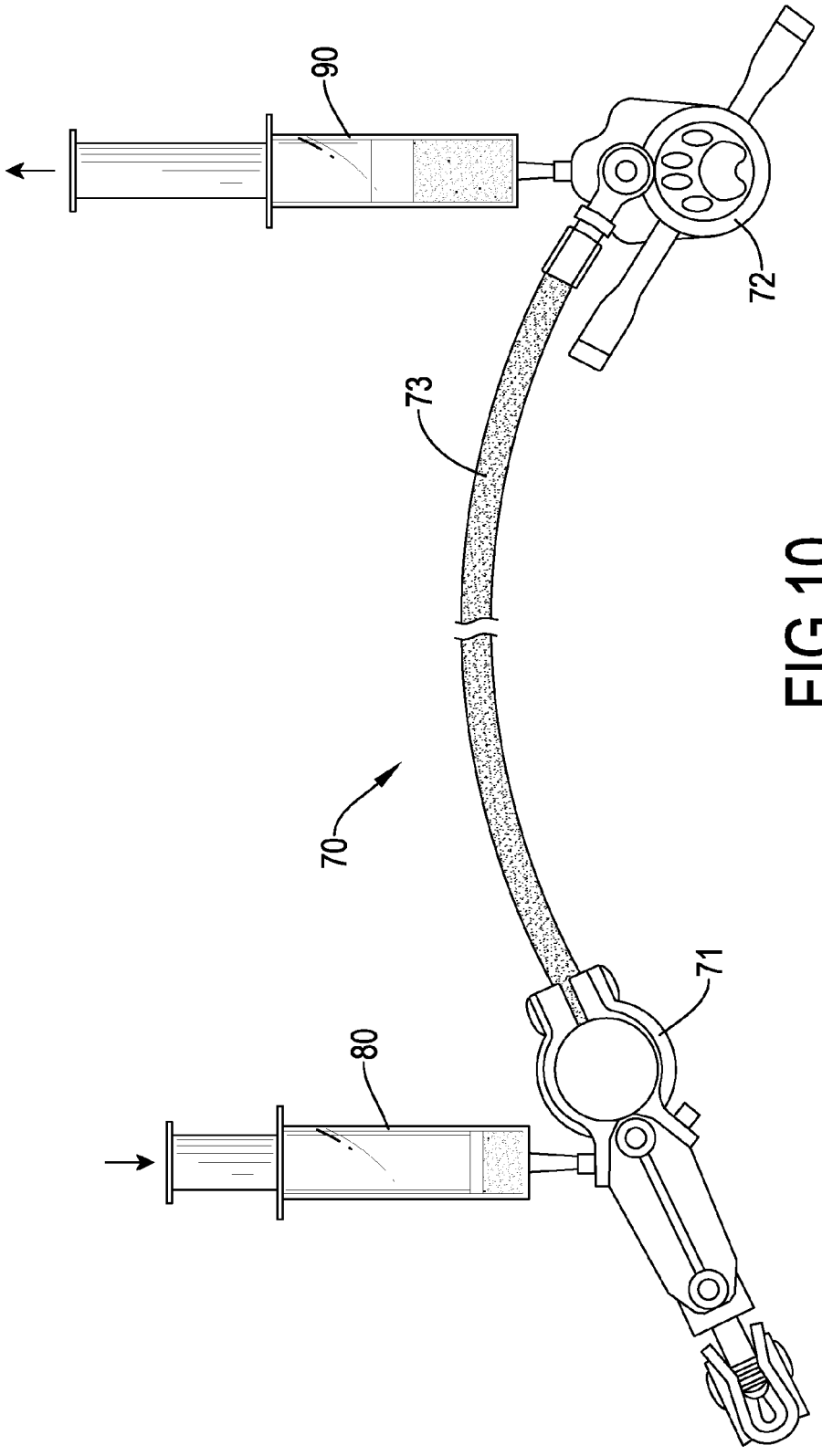

FIG.10
PRIOR ART

OIL REPLACEMENT APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an oil replacement apparatus, and more particularly to an oil replacement apparatus to replace oil automatically.

2. Description of Related Art

A conventional hydraulic brake assembly is filled with brake oil, and the brake oil often has to be replaced due to frequent use. With reference to FIGS. **9** and **10**, a conventional hydraulic brake assembly **70** is applied to replenish used brake oil manually.

The hydraulic brake assembly **70** has a grip unit **71**, a caliper unit **72** and an oil pipe **73**. Two opposite ends of the oil pipe **73** are respectively connected with the grip unit **71** and the caliper unit **72**. A first syringe **80** and a second syringe **90** are respectively connected with and communicate with the grip unit **71** and the caliper unit **72**.

With reference to FIG. **9**, to drain used oil out of the hydraulic assembly **70**, air is repeatedly and manually pumped by the first syringe **80** to flow into the grip unit **71**. The used oil in the hydraulic brake assembly **70** is driven by the air to flow out of the caliper unit **72**. Meanwhile the second syringe **90** works to draw the used oil, and enables the used oil to flow into the second syringe **90**. Accordingly, the used oil is drained out.

With reference to FIG. **10**, to inject new oil into the hydraulic assembly **70**, new oil is fully filled in the first syringe **80**. The new oil in the first syringe **80** is then manually injected into the hydraulic brake assembly **70**, and part of the new oil along with the residual air in the hydraulic brake assembly **70** is drawn into the second syringe **90**. Accordingly, the hydraulic brake assembly **70** is replenished with the new oil.

However, the manual replacing process is time-consuming. Moreover, the air in the environment easily enters the first syringe **80** during the period of that the first syringe **80** is filled with new oil, and then enters the hydraulic brake assembly **70**.

To overcome the shortcomings, the present invention tends to provide an oil replacement apparatus to mitigate the aforementioned problems.

SUMMARY OF THE INVENTION

The main objective of the invention is to provide an oil replacement apparatus to replace oil automatically.

An oil replacement apparatus has a housing, an oil replenishing assembly and a controlling assembly. The oil replenishing assembly has a base, a vacuum pump, an oil tank and multiple control cylinders. The base has a canal set formed inside the base. The vacuum pump and the oil tank are mounted on the base and communicate with the canal set. The control cylinders are mounted on the base to close the canal set and can selectively open or close holes of the canal set. The controlling assembly is connected with the oil replenishing assembly. Accordingly, the oil replacement apparatus can automatically drain or inject oil in a hydraulic brake assembly.

Other objects, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a first embodiment of an oil replacement apparatus in accordance with the present invention;

FIG. **2** is a perspective view of the oil replacement apparatus in FIG. **1** with the housing being removed;

FIG. **3** is an enlarged perspective view in partial section of the oil replacement apparatus in FIG. **1** showing the first channel;

FIG. **4** is an enlarged perspective view in partial section of the oil replacement apparatus in FIG. **1** showing the second channel;

FIG. **5** is an operational top view in partial section of the oil replacement apparatus in FIG. **1** showing the used oil being drained;

FIG. **6** is an operational top view in partial section of the oil replacement apparatus in FIG. **1** showing the new oil being injected;

FIG. **7** is a block diagram of the controlling assembly of the oil replacement apparatus in FIG. **1**;

FIG. **8** is an operational top view in partial section of a second embodiment of an oil replacement apparatus in accordance with the present invention;

FIG. **9** is an operational view of a conventional hydraulic brake assembly in accordance with the prior art showing the used oil being drained; and

FIG. **10** is an operational view of the conventional hydraulic brake assembly in FIG. **9** showing the new oil being injected.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference to FIGS. **1** to **4**, a first embodiment of an oil replacement apparatus in accordance with the present invention comprises a housing **10**, an oil replenishing assembly **20** and a controlling assembly **30**.

The housing **10** is a parallelepiped and has two opposite first side sections, two opposite second side sections, two housing openings **101**, a main space **102**, a secondary space **103**, two side plates **11**, a partition **12**, two casters **13**, a pillar **14**, a handle **15** and a jerrican **16**.

The house openings **101** are respectively formed in the first side sections of the housing **10**. The main space **102** and the secondary space **103** are formed inside the housing **10**. The side plates **11** are respectively formed on the second side sections of the housing **10**, and each side plate **11** is located between the two house openings **101**.

The partition **12** is latitudinally mounted inside the housing **10** to divide an inner space of the housing **10** into the main space **102** and the secondary space **103**. The secondary space **103** is located below the main space **102**.

The casters **13** and the pillar **14** are located at a bottom of the housing **10**. The handle **15** is located at a top of the housing **10**. The jerrican **16** is mounted in the secondary space **103**.

The oil replenishing assembly **20** is mounted in the main space **102** of the housing **10** and has a base **21**, a vacuum pump **22**, an oil tank **23**, multiple control cylinders **24**, an injection pipe **25** and a drainpipe **26**.

The base **21** is a parallelepiped and has an outer surface and a canal set **210**. The outer surface of the base **21** has two opposite first side sections, two opposite second side sections and a top section. The canal set **210** is formed inside the base **21** and has a first channel **211**, a second channel **212**, a pipe hole **213**, a tank-mounting groove **214** and a pump-mounting groove **215**.

The first channel **211** is T-shaped, is latitudinally formed through the base **21** and has a left end **2110**, a right end **2111**, a central segment **2112**, an oil inlet **2113**, a vent **2114** and an exit **2115**.

The left end **2110** and the right end **2111** of the first channel **211** are respectively formed in the first side sections of the outer surface of the base **21**, and respectively have an opening.

The central segment **2112** is formed between and connected with the left end **2110** and the right end **2111** of the first channel **211**.

The oil inlet **2113** is formed in the top section of the outer surface of the base **21** and is connected with and communicates with the left end **2110** of the first channel **211**.

The vent **2114** is formed in the top section of the outer surface of the base **21** and is connected with and communicates with the right end **2111** of the first channel **211**.

The exit **2115** is formed in one of the second side sections of the outer surface of the base **21** and is connected with and communicates with the central segment **2112** of the first channel **211**.

The second channel **212** is T-shaped, is latitudinally formed through the base **21**, is parallel to the first channel **211** and has a left end **2120**, a right end **2121**, a central segment **2122**, an oil entrance **2123**, a vent **2124**, a releasing hole **2125** and an oil outlet **2126**.

The left end **2120** and the right end **2121** of the second channel **212** are respectively formed in the first side sections of the outer surface of the base **21**, and respectively have an opening.

The left end **2120** and the right end **2121** are respectively adjacent to the openings of the second channel **212**.

The central segment **2122** is formed between and connected with the left end **2120** and the right end **2121** of the second channel **212**.

The oil entrance **2123** is formed in the top section of the outer surface of the base **21** and is connected with and communicates with the left end **2120** of the second channel **212**.

The vent **2124** of the second channel **212** is formed in the top section of the outer surface of the base **21** and is connected with and communicates with the right end **2121** of the second channel **212**.

The releasing hole **2125** is formed in the top section of the outer surface of the base **21**, is connected with and communicates with the central segment **2122** of the second channel **212**, and is located between the oil entrance **2123** and the vent **2124** of the second channel **212**.

With reference to FIGS. **2** and **5**, the oil outlet **2126** is formed in one of the second side sections of the outer surface of the base **21**, is connected with and communicates with the central segment **2122** of the second channel **212**, is opposite to the exit **2115**, is located between the releasing hole **2125** and the vent **2124** of the second channel **212**, and is connected with and communicates with the jerrican **16**.

The pipe hole **213** is formed in one of the second side sections of the outer surface of the base **21**, is connected with and communicates with the left end **2110** of the first channel **211**, and is adjacent to the oil inlet **2113**.

The tank-mounting groove **214** is annular, is formed in the top section of the outer surface of the base **21**, and encompasses the oil inlet **2113**.

The pump-mounting groove **215** is annular, is formed in the top section of the outer surface of the base **21** beside the tank-mounting groove **214**, and encompasses the vents **2114**, **2124**.

With reference to FIGS. **2** and **3**, the vacuum pump **22** is mounted into the pump-mounting hole **215** of the base **21** and communicates with the vent **2114** of the first channel **211** and the vent **2124** of the second channel **212**.

The oil tank **23** is mounted into the tank-mounting hole **214** of the base **21**, communicates with the oil inlet **2113** and the pipe hole **213** of the first channel **211**, and has an oleometer tube **231**, a check valve **232** and an aerometer **233**. The oleometer tube **231** is connected with and communicates with the pipe hole **213**, and is used to show the oil pressure of the oil tank **23**. The check valve **232** is connected with the releasing hole **2125**. The aerometer **233** is connected with the check valve **232**.

With reference to FIG. **5**, the control cylinders **24** are respectively mounted on the first side sections of the outer surface of the base **21** to close the openings of the first channel **211** and the second channel **212**. Preferably, four control cylinders **24** are implemented and are respectively inserted into the four openings of the first channel **211** and the second channel **212**. Each control cylinder **24** is pneumatic and has a movable cylinder rod. The cylinder rods of the four control cylinders **24** are respectively mounted in the left ends **2110**, **2120** and the right ends **2111**,**2121** of the first channel **211** and the second channel **212** in order to selectively open or close the oil inlet **2113**, the oil entrance **2123**, the vent **2124** of the second channel **212** and the vent **2114** of the first channel **211**.

With reference to FIGS. **1** and **2**, the injection pipe **25** is securely connected with and communicates with the exit **2115**. The drainpipe **26** is securely connected with and communicates with the oil entrance **2123**.

With reference to FIGS. **1**, **2** and **7**, the controlling assembly **30** is mounted in the main space **102** of the housing **10** and has a controller **31**, a switch unit **32**, a control valve unit **33** and a release solenoid valve **34**.

Preferably, the controller **31** is a programmable logic controller (PLC).

The switch unit **32** is mounted on the top of the housing **10**, is electrically connected with the controller **31** and has multiple switches capable of corresponding to commands in the controller **31**.

The control valve unit **33** is electrically connected with the controller **31** for being controlled by the controller **31** and is connected with the vacuum pump **22** and the control cylinders **24** by tubes. Preferably, the control valve unit **33** has multiple solenoid valves.

The release solenoid valve **34** is connected with the control valve unit **33** and the check valve **232**.

With reference to FIGS. **1**, **2** and **5**, the oil replacement apparatus in accordance with the present invention is connected with a hydraulic brake assembly **40** and is applied to drain used oil in the hydraulic brake assembly **40**. The hydraulic assembly **40** has a caliper unit **41** and a grip unit **42**. The injection pipe **25** is connected with the caliper unit **41**, and the drainpipe **26** is connected with the grip unit **42**.

First, the switch unit **32** is pressed and the controller **31** generates a command to activate the control valve unit **33**. Accordingly, the control valve unit **33** controls the four cylinder rods of the control cylinders **24** to move in order to selectively open or close the oil inlet **2113**, the oil entrance **2123**, the vent **2124** of the second channel **212** and the vent **2114** of the first channel **211**.

Second, the oil inlet **2113** is closed to prevent oil in the oil tank **23** from flowing out. The vent **2114** of the first channel **211** is opened, the oil entrance **2123** is opened, and the vent **2124** of the second channel **212** is closed. The vacuum pump **22** is controlled by the control valve unit **33** to blow air into the first channel **211** via the vent **2114** of the first channel **211**. Then, the air flows through the exit **2115**, the injection pipe **25** and into the caliper unit **41**.

Third, the used oil in the hydraulic brake assembly **40** is driven by the air and flows out of the hydraulic brake assembly **40**, into the drainpipe **26**, through the drainpipe **26** and the second channel **212**. Consequently, the used oil flows through the central segment **2122** of the second channel **212** and into the jerrican **16** via the oil outlet **2126**. Accordingly, the used oil is drained out automatically.

With reference to FIGS. **1**, **2** and **6**, the oil replacement apparatus in accordance with the present invention is applied to inject new oil into the hydraulic brake assembly **40**.

First, the oil inlet **2113** is closed. The vents **2114**,**2124** and the oil entrance **2123** are opened. The vacuum pump **22** completely draws out air in the base **21**, the injection pipe **25**, the hydraulic brake assembly **40** and the drainpipe **26** to vacuum the base **21**, the injection pipe **25**, the hydraulic brake assembly **40** and the drainpipe **26**.

Second, the oil inlet **2113** is opened to enable new oil in the oil tank **23** to flow out. The vent **2114** of the first channel **211** is closed, the oil entrance **2123** is closed, and the vent **2124** of the second channel **212** is closed. Because the base **21**, the injection pipe **25**, the hydraulic brake assembly **40** and the drainpipe **26** are vacuumed, the new oil is capable of flowing through the oil inlet **2113**, the exit **2115**, the injection pipe **25** and into the caliper unit **41**. During the replenishing process, the controller **31** and control valve unit **33** can control volume of the injected new oil.

Third, part of the new oil in the hydraulic brake assembly **40** flows out of the hydraulic brake assembly **40** and into the drainpipe **26** for ensuring the hydraulic brake assembly **40** is filled with new oil. Accordingly, the hydraulic brake assembly **40** is replenished with the new oil.

Finally, the release solenoid valve **34** is activated to let air in the environment flow into the second channel **212** via the releasing hole **2125**. The check valve **232** can prevent the air flowing toward the release solenoid valve **34**, and the aerometer **233** is used to measure the air pressure in the oil replenishing assembly **20**.

With reference to FIG. **8**, a second embodiment of the oil replacement apparatus is substantially the same as the first embodiment.

Two control cylinders **24**A are implemented, are respectively mounted on the first side sections of the outer surface of the base **21**A. Each control cylinder **24**A is pneumatic and has two movable cylinder rods respectively inserted into corresponding two of the openings of the first channel **211**A and the second channel **212**A at one of the first side sections of the outer surface of the base **21**A.

From the above description, it is noted that the present invention has the following advantages:

1. Automatic replacement:

The oil replacement apparatus in accordance with the present invention can automatically and precisely replace oil in the hydraulic brake assembly **40**, and this is greatly convenient and fast.

2. Prevention from penetration of air in the environment:

The vacuum pump **22** vacuums the base **21**, the injection pipe **25**, the hydraulic brake assembly **40** and the drainpipe **26** before the new oil is injected. Accordingly, air in the environment is prevented from entering the hydraulic brake assembly **40**.

What is claimed is:

1. An oil replacement apparatus comprising:

a housing having a main space formed inside the housing;

an oil replenishing assembly mounted in the main space of the housing and having:

a base having

an outer surface having

two opposite first side sections; and

two opposite second side sections; and

a canal set formed inside the base and having

a T-shaped first channel latitudinally formed through the base and having

two opposite openings respectively formed in the first side sections of the outer surface of the base; and

an exit formed in one of the second side sections of the outer surface of the base;

a T-shaped second channel latitudinally formed through the base, parallel to the first channel and having

two opposite openings respectively formed in the first side sections of the outer surface of the base;

an oil entrance formed in the outer surface of the base;

a releasing hole formed in the outer surface of the base; and

an oil outlet formed in the outer surface of the base, wherein the releasing hole is located between the oil outlet and the oil entrance;

a vacuum pump mounted on the base and communicating with the first channel and the second channel;

an oil tank mounted on the base, communicating with the first channel, and having a check valve connected with the releasing hole;

multiple control cylinders respectively mounted on the first side sections of the outer surface of the base to close the openings of the first channel and the second channel;

an injection pipe securely connected with and communicating with the exit;

a drainpipe securely connected with and communicating with the oil entrance; and

a controlling assembly mounted in the main space of the housing and having

a controller;

a switch unit electrically connected with the controller and having multiple switches capable of corresponding to commands in the controller;

a control valve unit electrically connected with the controller, and connected with the vacuum pump and the control cylinders by tubes; and

a release solenoid valve connected with the control valve unit and the check valve.

2. The oil replacement apparatus as claimed in claim **1**, wherein

four control cylinders are implemented and are respectively inserted into the four openings of the first channel and the second channel.

3. The oil replacement apparatus as claimed in claim **2**, wherein each control cylinder is pneumatic and has a movable cylinder rod.

4. The oil replacement apparatus as claimed in claim **1**, wherein

two control cylinders are implemented, are respectively mounted on the first side sections of the outer surface of the base; and

each control cylinder is pneumatic and has two movable cylinder rods respectively inserted into corresponding two of the openings of the first channel and the second channel at one of the first side sections of the outer surface of the base.

5. The oil replacement apparatus as claimed in claim 1, wherein

the controller is a programmable logic controller (PLC); and the control valve unit has multiple solenoid valves.

6. The oil replacement apparatus as claimed in claim 2, wherein

the controller is a programmable logic controller (PLC); and the control valve unit has multiple solenoid valves.

7. The oil replacement apparatus as claimed in claim 3, wherein

the controller is a programmable logic controller (PLC); and the control valve unit has multiple solenoid valves.

8. The oil replacement apparatus as claimed in claim 4, wherein

the controller is a programmable logic controller (PLC); and the control valve unit has multiple solenoid valves.

9. The oil replacement apparatus as claimed in claim 5, wherein

the housing has a partition mounted inside the housing to divide an inner space of the housing into the main space and a secondary space; and

a jerrican is mounted in the secondary space of the housing and is connected with and communicates with the oil outlet.

10. The oil replacement apparatus as claimed in claim 6, wherein

the housing has a partition mounted inside the housing to divide an inner space of the housing into the main space and a secondary space; and

a jerrican is mounted in the secondary space of the housing and is connected with and communicates with the oil outlet.

11. The oil replacement apparatus as claimed in claim 7, wherein

the housing has a partition mounted inside the housing to divide an inner space of the housing into the main space and a secondary space; and

a jerrican is mounted in the secondary space of the housing and is connected with and communicates with the oil outlet.

12. The oil replacement apparatus as claimed in claim 8, wherein

the housing has a partition mounted inside the housing to divide an inner space of the housing into the main space and a secondary space; and

a jerrican is mounted in the secondary space of the housing and is connected with and communicates with the oil outlet.

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